Title: Automated industrial leak tightness testers with mass spectrometers

Company: Vacuum Tightness and Measurement Technique Ltd.,

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Category: Industrial control solutions

Company profile: Founded in 2006 as a spin-off company of the Institute of Nuclear Research of the Hungarian Academy of Sciences with the aim to exploit expertise in vacuum technique and mass spectrometry in industrial leak tightness testing.

Task description: Some industrial products have to meet severe leak tightness specifications, e.g. houshold refrigerators, chest freezers, car lamps, etc. The emission limits are so low (e.g. 0.5 g per annum loss of isobuthane for houshold refrigerators) that mass spectrometric measurement is necessary to guarantee the required sensitivity in the time window (some tens of seconds) the production line speed permits. Our job was/is to design dedicated automated leak testers operated by the production lines. These tests are part of product QA/QC. All components of the leak testers are commercially available standard industrial products. Two types of leak testig were developed: components test before final assembly of the product (e.g. evaporator test before it is built into the refrigerator) and final check of the product (e.g. leak test of the refrigerator after charging with working substance and test run). The former uses helium as test gas, the latter checks the working substance.

Stages of development and construction: After specification of the problem we perform *laboratory experiments* to find the optimum solution and work out the test procedure for the actual workpieces. The important parameters are: sensitivity, tact time (speed), recovery time after a rough leak which can cause overload of the detector. Using lab results the design of the tester includes several other points dictated by the industrial environment, such as: connection of test pieces to the vacuum and/or gas handling system, handling system of the test gas, auxiliary tests (e.g. pressure test), automation, qualification, marking, records, safety rules, intelligent error monitoring and handling, operating more than one test stations etc. Lab tests requires flexible data acquisition and evaluation, testers are equipped with intelligent controller for automation.

Use of NI products: we have chosen LabVIEW and NI hardware for the following reasons:

- Software for laboratory experiments to optimize the test procedure and its parameters can be done rapidly using LabVIEW and can be run on the flexible PXI hardware
- PLC compatible control of testers (stand-alone) can be provided by NI Compact Field Point and Compact RIO hardware
- sophisticated procedures can be worked out in short time due to advanced services of PXI and LabVIEW
- The lab procedure is readily embedded in the real-time control of the testers
- PLC compatibility of the tester controllers
- Data analysis can be performed 'in flight', this enabled us to perform faster test procedures and simpler vacuum and gas harware compared to a PLC controlled tester

Tester statistics: we have constructed and delivered 13 testers, 11 of them are operated by production lines, 1 runs in a laboratory, 1 performs test runs before final installation and 3 more are in production.

Program family developed for testers in LabVIEW: we developed a LabVEW program 'frame' for the tester controllers which is deployed as a startup VI and runs the tester. The program 'frame' is the same for all the testers. The test procedure parameters are stored in a text file copied to the controller (e.g. by ftp) and the progam reads this file upon startup. In this way the modification of the test procedure which might be necessary, if the product was modified, can be done without modifying the VI deployed on the controller.

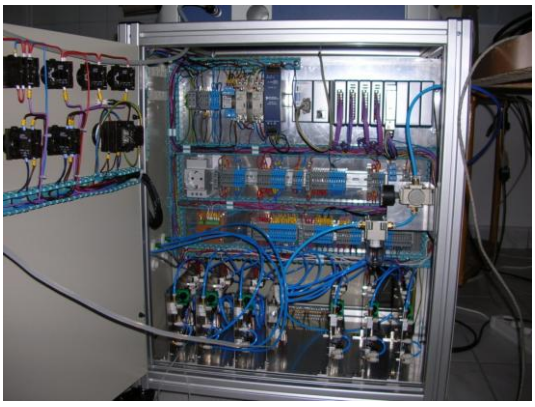

Fig. 1 Interior of an evaporator leak tester with cRIO controller

Fig 2 Tester for final check of household chest freezers

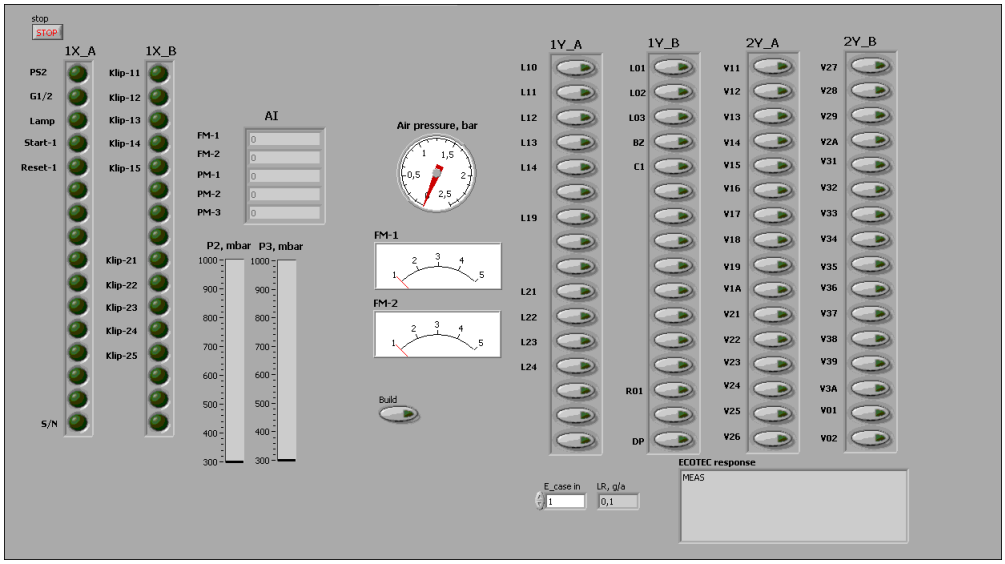

Fig 3 Front panel of the VI running on the tester in Fig 2